Patent Application

of

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for

EXCAVATOR BUCKET WITH RETAINAGE EJECTOR

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EXCAVATOR BUCKET WITH RETAINAGE EJECTOR

[1] **Field of the Inventi n**

[2] The present invention relates toexcavator or backhoes, and in particular, to buckets used on such devices to dig trenches and the like.

[3] **Background**

[4] In the past most trenching excavation was accomplishedby the use of trenching machines; however, since the advent of the Federal Occupational Health and Safety Act and its stringent and varying requirements dictating that the sides of excavations must be sloped in accordance with the type soil, the trenching machine has become limited in the areas where it may be used. Also, any trenching machine, without extensive modification, is limited to a given size and depth of trench. Muddy terrain and sticky soil conditions prohibit the use of trenching machines in many instances. Therefore, the backhoe or excavator with its greater versatility has become the most predominant excavation machine.

[5] The advent of the hydraulic backhoe has opened vast new fields for this machine in all types of construction. Hydraulics enabled designers to build very small to extremely large machines, all very powerful, but compact and maneuverable and at comparatively economical prices. Today it seems that everyone moves dirt with backhoes, and most manufacturers of earth moving equipmentbuild backhoes.

[6] A problem that plagues all backhoe users, is ejecting retainage material from the bucket when digging in sticky, cohesive material. Hydraulic backhoes allow a comparatively small machine to exert a tremendous force on the bucket. The

bucket is constructed long and deep in order to utilize this force. To facilitate easy movement through the cut and to enable the operator to trim the sides of the cut, the bucket is flared in front, that is, the bucket is wider in front than in the back. This feature also speeds the dumping of excavated material.

[7] The flared design of the bucket is ideal under most conditions and allows a maximum amount of material to be excavated and carried by each cycle of the machine; however, in muddy, sticky conditions ithas the opposite effect because the tremendous forces involved compacts the sticky material into the tapered bucket to such a degree that it will not eject, or dump out.

[8] This problem accounts for the vast majority of hydraulic and mechanical failures of the machine when digging in muddy and otherwise easy conditions. When this soil condition is encountered and the retainage material does not eject, the operator first attempts to remove the material by shaking the bucket,. This is usually done with the boom fully extended and the bucket in the dump position by moving the control levers rapidly back and forth, thereby creating incalculable pressures and surges in the hydraulic system. These pressures and surges put undue and many times prohibitive stress onthe entire hydraulic system, causing failures of hose, valves, pumps, cylinders etc. Rapid movement of the heavy extended load also places great strain and shock on all of the mechanical and structural components of the machine. Failing to eject in this manner, other attempts are made, such as pounding the bucket against the ground, rocks, or other objects. This action not only results in frequent failure to eject the load, but also does expensive damage to the bucket and machine, andincreases the time required to complete the excavation project. Extraction of the material by hand

using sharpshooters and bars is difficult and time consuming and is usually resorted to only once or twice per day. Normally, under these conditions, the operator will simply continue to dig with a partially filled bucket and the only material excavated is that amount which can be heaped on top of the already packed bucket. This makes the machine work extremely hard and the rate of production is greatly reduced.

[9] The foregoing problems are exacerbated as the width of the bucket decreases. The narrower the bucket, the more likely it is that the bucket will have retainage in need of ejectment. Some operators resort to simply using a wider bucket than is required for the particular job, such as digging a twelve inch trench for a pipe where only a 6 inch trench is required. This necessarily increases the time to dig the trench. Moreover, trenches are often filled with gravel, crushed stone or other aggregate. If a trench is wider than necessary, then more aggregate will be required to fill the trench. This can significantly increase the overall cost of the project.

[10] In the past there has been a number of attempts to build bucket cleaners, but to date, none appear to have been completely successful. All known approaches to solving this problem have been mechanically actuated with a cleaner bar mounted in and remaining inside the bucket. There are a number of problems associated with this approach and at the present time, results are not satisfactory.

[11] It is therefore desirable to provide an excavator bucket with a retainage ejector that allows the retainage to be quickly, automatically, and effectively ejected from the bucket.

[12] Shield, U.S. Pat. No. 2,402,299, proposes a shovel having acurved bottom wall of constant diameter within which there is pivotally positioned a bulkhead. The bulkhead is actuated by a cable which is rove about pulleys in a manner which moves the bulkhead to discharge the contents of the bucket therefrom.

[13] Cunningham, Jr., U.S. Pat. No. 2,885,103, proposes a blade member for a loader bucket whereby the load can be ejected therefrom by the provision of an ejector blade mounted to move along the curve portion of the bucket. The blade is pivotally connected in such amanner that it descends into and wipes out the bucket. The blade of Cunningham, Jr. is affixed to and moves with the bucket.

[14] Perkins et al, U.S. Pat. No. 2,812,872, provides a bucket cleaning apparatus by the provision of an ejector plate 41 pivotally comected to lugs 52 formed on the dipper stick. When the dipper or bucket 35 is pivoted into a dumping position, the ejector plate is held in fixed positional relative to the dipper arm 31 and forcibly ejects material from the bucket.

[15] Hemphil, U.S. Pat. No. 4,032,015, discloses a blade member is slidably affixed to the pivoted end of a boom that can be retracted clear of the path of travel of the backhoe bucket as the bucket is curled and uncurled. The blade member is extensible into engagement with the bottom of the digging bucket so that as the bucket is uncurled, the end of the blade is progressively extended and follows the irregular bottom surface of the bucket, thereby discharging the contents therefrom.

[16] Satterwhite, U.S. Pat. Nos. 4,162,584 and4,180,927 reveal a vehicle with plural excavating wheels each comprising a plurality of digging buckets having a wall

supported for pivotal movement between a material receiving position and a material dumping position. A spring is connected to each movable wall for normally positioning the wall in the material receiving position. A cam mounted on each movable wall is engaged by a mechanism fixedly supported at a point offset from the rotational axis of the excavating wheel to pivot each movable wall to the material dumping position against the action of the spring associated therewith.

[17] **Summary of the Invention**

[18] The invention comprises an excavator bucket connectable to a boom and being pivotable with respect to the boom. The bucket has opposing side walls in a fixed position with respect to each other and each having a front edge and a back surface. The back surface is movable between a first position that substantially defines the capacity of the bucket, and a second position toward the front edges of the sidewalls. When the back surface is moved from the first position toward the second position, retainage that may be adhered to the interior side walls of the bucket is forced out of the bucket by the back surface. The back surface may have an actuating member to facilitate its movement from the first position to the second position upon moving the excavator bucket toward a predetermined angular orientation with respect to the boom.

[19] In one embodiment of the invention, the bucket further includes a biasing means, such as a spring, for biasing the back surface toward the first position. Moreover, the bucket may include a back structural support surface that connects the opposing side walls and which engages the back surface when the back surface is in the first position. This back structural support surface may

have an aperture though which the actuating member passes. The actuating member may engage the boom to which the bucket is attached to cause the back surface to move from the first position toward thesecond position.

[20] **Brief Description of the Drawings**

[21] Fig. 1 is a side section view of the excavator bucket where the bucket is in a digging position, and in which the back surface is in the first position.

[22] Fig. 2 is a side section view of the excavator bucket where the bucket is extended with respect to the boom, and in whereby the actuating member has engaged the boom to move the back surface toward a second position, thereby ejecting any retainage from the bucket.

[23] Fig. 3 is a perspective view of the back of the bucket showing the actuating member engaging the boom and the bias means.

[24] Fig. 3 is a perspective view of the back of the bucket showing the actuating member engaging the boom and the bias means.

[25] Fig. 4 is a perspective view of the front of the bucket and showing the back surface in its first position.

[26] Fig. 5 is a front view of an alternate embodiment of the back surface, wherein it includes a centrally disposed ridge to improve its structural integrity.

[27] Fig. 6 is a front view of the bucket with the back surface removed to reveal the aperture in the back support structure of the bucket through which the actuating member may pass.

[28] Fig. 7 is a front view of an alternate embodiment of a bucket with the back surface removed. In this embodiment, aperture is much larger.

[29] **Detailed Description**

[30] Fig. 1 is a side section view of the excavator bucket where the bucket is in a digging position, and in which the back surface is in the first position. Boom 11 pivotally attaches to bucket 12 via pins 13which connect to ears 14 of the bucket. Buck 12 includes opposing side walls 15 (see Fig. 4) which are in a fixed position with respect to each other and each having a front edge 16. Bucket further includes back surface 17, which in the shown embodiment is attached to the upper interior of the bucket by hinge 18.

[31] Back surface 17 is movable between a first position as shown in Fig. 1 whereby it substantially defines the capacity of the bucket, and a second position as shown in Fig. 2 whereby back surface 17 has moved toward the front edges 16 of side walls 15.

[32] When in operation, the bucket may be prone to become impacted with retainage which sticks to the interior side walls of the bucket. However, in accordance with the present invention, some or all of such retainage may be ejected by moving the back surface 17 toward the second position. By such movement, the back surface dislodges retainage stuck to the side walls as the back plate moves toward the second position. In one embodiment, such movement toward the second position is effected simply by moving the bucket with respect to the boom to an extended position. It will be appreciated that actuating member 19 is connected to back surface 17. When bucket 12 is in a working, or (in this case,

non-extended) position, actuating member is spaced from boom. However, as piston 20 is retracted into hydraulic cylinder 21, the bucket is extended, and actuating member 19 thereby contacts boom 11 and forces back surface from its first position toward its second position.

[33] After the retainage has been substantially ejected, the bucket may be moved back to the digging position shown in Fig. 1. As this is done, a bias means, for example, the combination of bolt 22 and spring 23, moves the back surface back into the first position.

[34] Back surface may be formed from 3/8" coldrolled steel plate, bent using a press to substantially conform the back of a bucket. Actuating member 18 may be formed by a 1.5" x 3" solid steel barand may be welded to the back of bucket 12. Actuating member 18 may be straight or curved, depending on the its distance from the bucket pivot point 13, and the. The length and curvature of actuating member may be selected to accommodate the particular brand of the boom and bucket used in connection with the invention, as long as the actuating member operates to cause the appropriate movement of the back surface from its first position toward its second position. Specifically, the actuating member should be positioned to extend from the back surface so that, when it contacts the boom (providing a predetermined angular orientation of the bucket with respect to the boom), the actuator causes the back surface to move from the first position toward the second position.

[35] Moreover, if desired, the part of the boom thatis contacted by the actuating member may be reinforced, for example by welding an additional steel plate to

the boom, to help reduce the wear on the boom resulting from it being contacted by the actuating member.

[36] The bias means may comprise a 7/8" bolt, which passes through a mating hole in the back surface, and a slot in the back of thebucket and receives spring __ which is secured to bolt by washer36 and nut 34. In addition, washer35 may be disposed between the spring and the bucket. In one embodiment, the bolt and spring should be sized to accommodate 2" to 7" of travel as the back surface 17 moves between its respective positions. Spring should have enough extension force to apply 30 lbs.of force, to thereby move back surface 17 to the first position. While the forgoing specifications have been found suitable for a 12 inch excavator bucket, other sizes and strengths may of course be selected to provide optimal configurations for buckets of other sizes. It will be appreciated that as back surface 17 pivots, the angular orientation of bolts 22 will change with respect to the back of bucket. This change ofangle may be accommodating by forming slots in back of the bucket, as shown as 30 in Figs. 6 and 7.

[37] Fig. 2 is a side partial section view of the excavator bucket where the bucket is extended with respect to the boom, and in whereby the actuating member has engaged the boom to move the back surface toward a second position, thereby ejecting any retainage from the bucket.

[38] Fig. 3 is a perspective view of the back of the bucket showing the actuating member engaging the boom and the bias means. From this view, it is evident that the back of bucket 31 includes aperture 32 through which actuating member 19 passes to allow engagement with boom 11 as thebucket is extended by

retracting piston 20. Also, the detail of bolts 22 and springs 23 may be appreciated which provide means to bias the back plate toward its first position. In one embodiment, bolt– spring combinations are positioned on both sides of the back of the bucket.

[39] Fig. 4 is a perspective view of the front of the bucket and showing the back surface in its first position. From this view, the opposing side walls 15 may be appreciated, as well as the front edges 16 of these walls. It will be evident to those of skill in the art that when in use, retainage may adhere to side walls 15, but the retainage will be ejected when back surface 17 is moved towards its second position toward the front edges 16 of bucket 12. It will be further appreciated that back surface 17 may be affixed to the top edge of bucket 12 by hinge 18.

[40] Fig. 5 is a front view of an alternate embodiment of the back surface, wherein it includes a centrally disposed ridge 40 to improve its structural integrity. Also visible from this figure are the holes 41 in back surface through which bolts 22 may pass.

[41] Fig. 6 is a front view of the bucket with the back surface removed to reveal the aperture 32 in the back support structure of the bucket through which actuating member 19 may pass. Also visible in this view are slots 30 through which bolts 22 pass. Slots may be preferred as opposed to simple holes as the angular orientation of bolts 22 with respect to bucket 12 will vary depending on the position of back surface 17.

[42] Fig. 7 is a front view of an alternate embodiment of a bucket with the back surface removed. In this embodiment, aperture33 is much larger. It will be appreciated that because back surface 17 in essenceengages aggregate during digging, what is normally the back ofbucket 12 is not actually necessary. Accordingly, removing the central portion of the back of bucket 12 reduces the weight and cost of the bucket. However, it is advisable to retain the perimieter of the back of the bucket so as to provide support for back surface 17 during excavating operations.

[43] Those of skill in the art will appreciate that during use, if a bucket becomes clogged with retainage, such retainable may be easily ejected by simply extending the bucket with respect to the boom as shown in Fig. 2, which will cause back surface 17 to move toward the front edges 17 of the bucket. Moreover, the invention as described may be implemented merely by providing a bucket as shown and described; no changes to the excavator are mandatory. Accordingly, the present invention provides a easy and low cost way to eject retainage from excavator buckets.

[44] It will be understood that various details of the invention may be changed without departing from the scope of the invention. Furthermore, the foregoing description is for illustration only, and not for the purpose of limitation, the invention being defined by the claims.